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(54) IMPROVEMENTS IN OR RELATING TO PIEZO-ELECTRIC IGNITERS FOR LIGHTERS

(71) We, BRAUN AKTIENGESELLSCHAFT, a German Body Corporate, of 22 Rüsselsheimer Strasse, 6 Frankfurt-am-Main, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to piezo-electric igniters which have a striker which is actuated by a spring constituting an energy store. The spring is first loaded by an operating element at one end, denoted the "loaded side", and a catch retains the striker attached to the opposite end of the spring until the spring loading has reached a predetermined value. The catch is removed by further movement of the operating element, whereupon the striker falls on to the piezo-element, to strike and compress that element, and the resulting spark ignites the fuel-air mixture given off by the lighter.

Such arrangements have a number of disadvantages. Thus, the spring first occupies a space which corresponds to the unloaded state. The striker, which unloads the spring after loading, moves through a distance which corresponds to the difference between the loaded and unloaded state of the spring and so occupies further space, at the expense, for example, of reservoir space. Moreover, a catch mechanism of several parts is required which must be capable of taking a heavy load and accurate enough to ensure a smooth sequence of precise and consistent movements.

The high loading capability which is demanded is often not attained, so that the useful life of an igniter of this kind is conditioned not only by the life of the piezo-element subjected to striking but by the wear and tear on the catch mechanism.

According to the invention, there is provided a piezo-electric igniter, comprising a manually operable control element, a striker, an elastic element providing an energy store and at least one piezo-element, wherein the striker is permanently connected to the loaded side of the elastic element and to the control element.

The elastic element can then be stressed or released without parts sliding on one another under load pressure, so that wear and tear is greatly reduced and ignition can be triggered by simple release of the operating element. A further advantage is that the space requirement for the deflection needed is small. Moreover, the user feels the direct relation between the applied force and the sparking strength. Thus a reliable igniter is provided which takes advantage of modern advances in the art and which possesses the mechanical and acoustic properties of older flint lighters.

In one embodiment of the invention, the loaded side of the elastic element is connected to the reciprocating end of the connecting rod of a crank mechanism, and the control element is connected to the crank end of the connecting rod. This arrangement provides loading means without parts which slide on one another, the power characteristic of which can be chosen or varied by adjusting the end of the loading travel of the control element. The end of the loading path of the control element preferably lies at the upper slack point of the crank mechanism.

The advantage of this arrangement is that the deflection of the elastic element changes sinusoidally so that the operating power is applied advantageously. As the operating element is moved, small paths are traversed in the elastic element with small gain of energy and longer paths with larger energy gain. In this manner, the sensitivity of operation at the end of the loading travel of the operating element is increased. Further advantage is gained by providing a stop to limit the loading travel. The user then obtains a reliable feel for the final state of the mech-

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anical loading process, especially when the stored energy increment is small at the end of the loading travel.

Embodiments of the invention as applied to a cigarette lighter will now be described by way of example and with reference to the accompanying drawings in which:—

Figures 1 and 2 are diagrammatic side views of a cigarette lighter incorporating one embodiment of the invention prior to and during operation,

Figures 3 and 4 are diagrammatic side views of a cigarette lighter incorporating a second embodiment,

Figure 5 is a side view of a cigarette lighter incorporating a third embodiment, and

Figure 5*a* illustrates a variant of the arrangement of Figure 5.

Referring to Figures 1 and 2, a lighter housed in a case 16 has a control element 4 which acts directly on a stressable, elastic element in the form of a spring 2.

Figure 1 shows the arrangement of the start of the loading process and Figure 2 at the moment of release of the control element. One end of a slot in the case 16 forms a stop 16*a* for the control element 4, which is movable in the slot. After release, a striker 3 strikes against a piezo-element 1 and thus produces the desired ignition spark.

In the arrangement of Figures 3 and 4, linear deflection of striker 3 is replaced by a turning movement about an axis 5 for the tensioning of a spring 2. The spring 2 can be replaced by a torsion spring along the axis 5. A stop 16*a*, comparable to that in Figures 1 and 2, can be provided to limit the path of the control element 4 in such arrangements with a turning action.

The opening of a valve 9, which releases the fuel from a reservoir 10 in the arrangement of Figures 1 to 4, is effected by means of a separate, for example hand-operated, lever which can, for example, be in the form of a covering cap and which, for purposes of simplification, is not shown.

In the arrangement shown in Figure 5, the elastic element in the form of a helical spring 2 drives the striker 3 against piezo-element 1. The arrangement is actuated by control element 4 which is directly connected to the crank 6 of a crank mechanism 6, 7 the crank being mounted on a pivot 5. The distortion axis A of the elastic element 2 contains the slack point of the crank mechanism 6, 7. When operating element 4 is moved in the direction of arrow B, crank 6 loads the spring 2 through a connecting rod 7 in the direction of the distortion axis A. The travel of control element 4, or of the crank mechanism 6, 7, is limited by a stop 16*a* before the upper slack point of the crank mechanism is reached. The arrangement comprising the crank mechanism 6, 7, loading path B, distortion axis A and stop 16*a* results in a reduction in the leverage in the zone of the strongest forces which arise, and a great sensitivity of operation is obtained, aided by the effect of the stop.

Towards the end of the operating movement, valve 9, which is located on the reservoir, is opened by a coupling part 8 and is locked in the open position, so that a combustible fuel-air mixture 14 is formed. When operating element 4 is released, the striker 3 falls back and piezo-element 1 develops a high-voltage impulse which is applied over conductors 12 to electrodes 13. The resulting spark at electrodes 13 ignites the mixture 14. The whole arrangement is accommodated in case 16 and a filler opening 17 is provided for charging the lighter with fuel.

Figure 5*a* shows part of an igniter having a similar power characteristic to that of the crank mechanism described with reference to Figure 5. When the elastic element 2, 2 is loaded in the direction of arrow B by the control element 4, the compression axes A of springs 2, 2 move in the same direction as the striker 3 and the springs 2, 2, after release, accelerates the displacement of striker 3 in the direction of piezo-element 1. The sequence of movements resulting in ignition of the fuel then follows as in the arrangement of Figure 5.

The extinguishing of the flame in the arrangement of Figures 1 to 5*a* takes place by closure of the valve 9.

WHAT WE CLAIM IS:—

1. A piezo-electric igniter, comprising a manually operable control element, a striker, an elastic element providing an energy store and at least one piezo-element, wherein the striker is permanently connected to the loaded side of the elastic element and to the control element.

2. An igniter according to claim 1, wherein the loaded side of the elastic element is connected to the reciprocating end of the connecting rod of a crank mechanism and the control element is connected to the crank end of the connecting rod.

3. An igniter according to claim 2, wherein the end of the loading path of the control element lies at the upper slack point of the crank mechanism.

4. An igniter according to claim 1, 2 or 3, wherein the loading path of the control element is limited by a stop.

5. An igniter according to claim 1, wherein the elastic element is in the form of a torsion spring.

6. A piezo-electric igniter, substantially as herein described with reference to Figures 1 and 2, or Figures 3 and 4 or Figure 5 or Figure 5*a* of the accompanying drawings.

7. A lighter having a piezo-electric igniter according to any preceding claim.

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1404381 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

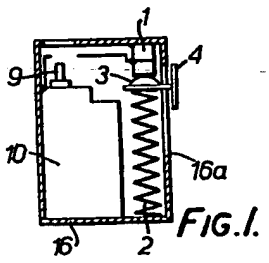

FIG.1.

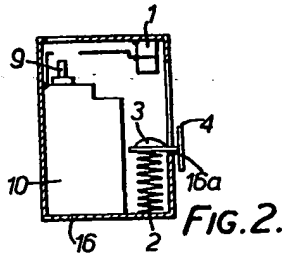

FIG.2.

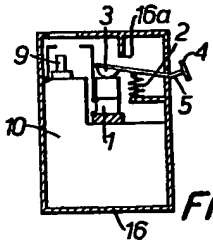

FIG. 3.

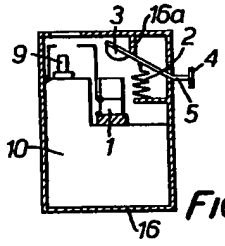

FIG.4.

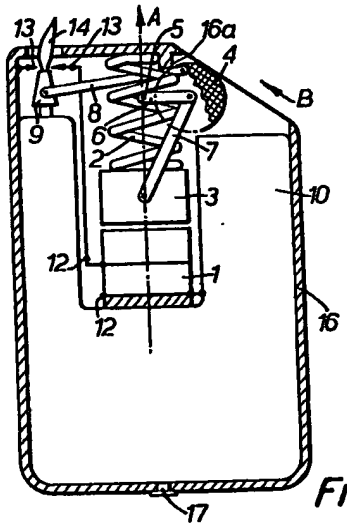

FIG. 5.

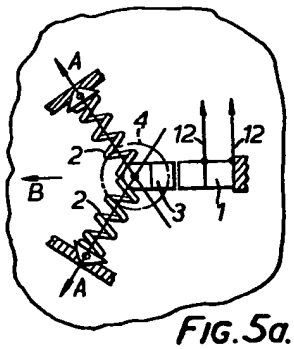

FIG.5a.